

STUDIES IN OTIOPHORA ZUCC. (RUBIACEAE):

2. A NEW CLASSIFICATION OF THE SOUTHERN AFRICAN TAXA

CH. PUFF

(Institute of Botany, University of Vienna, Austria)

ABSTRACT

Six taxa of *Otiophora* occur in and are confined to southern Africa: *O. calycophylla* subsp. *calycophylla* from the Magaliesberg, N. Transvaal and Natal, and *O. calycophylla* subsp. *verdcourtii* (subsp. nov.), endemic to the E. Soutpansberg; *O. cupheoides*, following the Drakensberg escarpment from the E. Transvaal to Swaziland; *O. inyangana* subsp. *inyangana*, widely distributed in the E. Highlands of Zimbabwe (Rhodesia) and neighbouring Mozambique, *O. inyangana* and subsp. *parvifolia* (stat. nov.), a Chimanimani quartzite endemic; *O. lanceolata*, narrowly endemic to the Haroni-Makurupini area.

O. calycophylla subsp. *calycophylla* and *O. calycophylla* subsp. *verdcourtii*, *O. cupheoides*, and *O. inyangana* subsp. *inyangana* have a chromosome number of $n = 17$ and $2n = 34$; pollen measurements indicate that the remaining two taxa are on the same ploidy level.

Investigations into the possible causes of morphological variability of some of the taxa revealed that, at least in *O. cupheoides* and *O. inyangana* subsp. *inyangana*, fire plays an important role; the effect of other environmental factors is also briefly discussed.

UITTREKSEL

STUDIES IN OTIOPHORA ZUCC. (RUBIACEAE):

2. 'N NUWE KLASSIFIKASIE VAN DIE SUIDER AFRIKAANSE TAKSA

Ses taksa van *Otiophora* kom voor in en is beperk tot Suider Afrika: *O. calycophylla* subsp. *calycophylla* vanaf Magaliesberg, N. Transvaal en Natal en *O. calycophylla* subsp. *verdcourtii* (subsp. nov.), endemies aan die Oos-Soutpansberg; *O. cupheoides* op die Drakensberg platorand van O. Transvaal tot Swaziland; *O. inyangana* subsp. *inyangana*, wydverspreid in die Oostelike Hooglande van Zimbabwe (Rhodesië) en naburige Mosambiek, en *O. inyangana* subsp. *parvifolia* (stat. nov.). 'n Chimanimani endemiese op kwartsiet; *O. lanceolata*, eng endemies tot die Haroni-Makurupini gebied.

O. calycophylla subsp. *calycophylla* en *O. calycophylla* subsp. *verdcourtii*, *O. cupheoides* en *O. inyangana* subsp. *inyangana* het 'n chromosoomgetal van $n = 17$ en $2n = 34$; beoordeel aan stuifmeelmetings is die oorblywende twee taksa op dieselfde ploëidvlak.

'n Ondersoek na die moontlike oorsake van die morfologiese veranderlikheid van sommige taksa blyk dat, ten minste by *O. cupheoides* en *O. inyangana* subsp. *inyangana*, vuur 'n belangrike rol speel; die invloed van andere omgewingsfaktore word ook kortliks bespreek.

INTRODUCTION

Otiophora Zucc., a genus centred in tropical Africa and also occurring on Madagascar, is represented in southern Africa by several isolated and endemic

taxa¹. Although the genus has been monographed fairly recently (Verdcourt, 1950), particularly in southern Africa a number of taxonomic problems such as the variability of *O. inyangana* N.E.Br. and its taxonomic treatment (Verdcourt, l.c.) or the distinctiveness of *O. calycophylla* (Sond.) Schlecht. & K. Schum. and *O. eupheoides* N.E.Br. (Verdcourt, 1973) has remained unsolved, possibly because the monographer of the genus was not acquainted with the southern African plants in the field and had based his revision on herbarium material. With this in mind, a special attempt was made to undertake an extensive field study.

A new classification of the southern African taxa is presented, based on these field studies and a thorough investigation of the herbarium material available, coupled with karyological investigations and pollen measurements.

MATERIAL AND METHODS

In addition to documentation material brought back by the author from field excursions in South Africa, Swaziland, and Zimbabwe (Rhodesia) (deposited at the herbaria J and/or WU; some duplicates at BR), *herbarium specimens* from the following herbaria were investigated: B, BOL, BR, E, G, GRA, J, K, LISC, MO, NBG, NH, NU, P, PRE, S, SAM, SRGH, STE, W, WU, and Z (abbreviations after *Index Herbariorum*, Holmgren & Keuken, 1974).

For *karyological investigations*, flowers, buds or shoot apices were fixed in the field in 3 parts 95 % alcohol and 1 part HOAc. Preparations were examined using either the conventional squash method (with acetocarmine as stain) or a new method developed by Guerra (1980). Methods/materials for *pollen measurements* are described in Puff (1976).

SEM investigations (Figs 5 and 8) were carried out in a Jeol JSM-T20 Scanning Microscope at the EM Unit, University of the Witwatersrand. Plant parts were fixed in the field in 2.5 % glutaraldehyde in cacodylate buffered sucrose (pH 7.4), then critical point dried and coated with gold-palladium.

The presentation of *distribution records* follows Puff (1978).

KARYOLOGY AND POLLEN MEASUREMENTS

The small size of the chromosomes (c. 0.9–1.3 μm in metaphase I and II of PMC meioses, and even smaller in somatic mitoses) makes chromosome-morphological studies impossible. No disturbances were observed in mitoses. Meioses of PMCs take place at a very early stage of development of the flowers (the buds are hardly 1 mm long; flowers strongly protandrous). Meiotic irregularities (mainly clumping of chromosomes) were only observed in PMCs of buds

¹ Another species, *O. scabra* Zucc. (subsp. *scabra*), also occurs in southern Africa. This species, not closely allied to the strictly southern African taxa, merely reaches its southern limit of distribution in Zimbabwe (Rhodesia). It is, therefore, only included in the key and distribution map (Fig. 10). For further information on *O. scabra*, see Puff (1981).

developing unusually late (i.e. buds near the apex of already fruiting inflorescences); it is doubtful whether such buds ever develop fully into flowers.

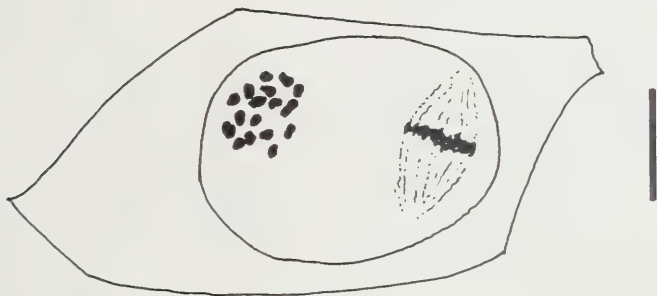


FIG. 1.

Camera lucida drawing of pollen mother cell (metaphase II) of *O. calycophylla* subsp. *verdcourtii* (Puff 791202-2/2). The bar represents 10 μ m.

All taxa investigated karyologically (Table 1) have a chromosome number of $n = 17$ (cf. Fig. 1) and $2n = 34$. This is the same number counted for *O. scabra* subsp. *scabra* (Puff, 1981). The apparent chromosome base number of the genus ($x = 17$) is much-derived and highly unusual in Rubiaceae-Rubioideae. It differs markedly from the base number of African Rubiaceae-Anthospermeae ($x = 11$; Puff, unpublished), to which *Otiophora* was thought to belong¹.

The pollen is fully developed (trinueate) before the buds open. Pollen quality varies: in most flowers (buds) nearly all grains are well developed and abnormal grains (i.e. dead grains not stained red with acetocarmine or exceptionally large grains) are rare; in some the majority of grains are dead (this was sometimes observed in flowers of a single inflorescence, particularly in *O. cupheoides*).

A comparison of average pollen diameters (Fig. 2) of the karyologically known taxa with those of *O. inyangana* subsp. *parvifolia* and *O. lanceolata* leaves little doubt that the latter are on the same ploidy level.

It is interesting to note that the average pollen diameters of the South African species group (*O. calycophylla* and *O. cupheoides*) are clearly bigger than those of the other taxa (compare Fig. 2 a-c and 2 d-f). Because of the relatively small number of samples measured, this difference may not be a true reflection of the situation. The difference, on the other hand, may indicate a much less

¹ A publication dealing with the taxonomic affinities of the genus, Paper 4 of the series "Studies in *Otiophora* Zucc. (Rubiaceae)", is in preparation.

TABLE 1.
Voucher Specimens for Chromosome Counts

	<i>n</i>	<i>2n</i>	Number of individuals investigated
<i>O. calycophylla</i> subsp. <i>calycophylla</i> Magaliesberg: ¹			
Puff 790307-2/1 ² (BR, J, WU)	17	34	3
Puff 790706-1/1 (WU)		c.34	2
Northern Transvaal: ¹			
Scholes sub Puff 781218-1/1 (WU)	c.17		1
Puff 791202-3/2 (J)	17	34	4
<i>O. calycophylla</i> subsp. <i>verdcourtii</i> Northern Transvaal: ¹			
Puff 791201-1/1 (J)	17		2
Puff 791201-3/2 (J)	17	c.34	2
Puff 791201-4/2 (J)	17		3
Puff 791202-2/2 (J) (Fig. 1)	17		1
<i>O. cupheoides</i> Eastern Transvaal: ¹			
Puff 780902-1/1 (BR, J, WU)		34	1
Puff 790211-4/1 (J, WU)	17	34	2
Puff 790704-1/1 (BR, J, WU)	17	34	4
Puff 791208-1/1 (WU)	17		2
Swaziland: ¹			
Puff 770118-3/8 (WU)	17		1
Puff 790225-1/3 (WU)	17	34	2
<i>O. inyangana</i> subsp. <i>inyangana</i> Zimbabwe (Rhodesia), Inyanga Distr. ¹ :			
Puff 790124-2/1 (WU)	17		2
Puff 790125-1/2 (WU)	17	c.34	2
Puff 790126-1/1 (WU)	17		3
Zimbabwe (Rhodesia), Umtali Distr. ¹ :			
Puff 790127-2/2 (WU)	17		1
Puff 790128-1/4 (WU)	17	34	3

¹ Exact localities in "Collections".

² The date, on which the voucher specimen was collected and the fixation made, is incorporated in Puff collecting numbers: 790307 = March 7th, 1979; -2/1 = first plant collected in the second locality visited on that day.

close affinity between the two species groups (and between *O. cupheoides* and *O. inyangana* in particular) than the morphological resemblances lead us to believe.



FIG. 2.

Average pollen diameters in μm of *O. calycophylla* subsp. *calycophylla* (a) and subsp. *verdcourtii* (b), *O. cupheoides* (c), *O. inyangana* subsp. *inyangana* (d) and subsp. *parvifolia* (e), and *O. lanceolata* (f). Black: individuals investigated karyologically; vertical scale: no. of individuals.

VARIABILITY

All southern African taxa of *Otiophora* show considerable variation in vegetative and, to a certain extent, floral and inflorescence characters. Characters commonly affected by this variability are growth habit (stems erect, sprawling or straggling, or stems $\pm$ prostrate and much-branched, giving rise to cushions or mats), hairiness, spacing and arrangement of the leaves (decussate or whorled), leaf size, shape and texture, length of fruiting inflorescence, and corolla tube lengths.

To determine the possible cause(s) of this variability and the extent of variation, considerable time was spent in the field analyzing populations. In addition to ecological records, collections were made of a representative number of individuals showing the whole range of variation within a population for further investigations in the laboratory. For each population, this was supplemented by cytological and morphological/anatomical fixations of a few selected plants.

The Influence of Fire

It became obvious from field studies, that in *O. cupheoides* and *O. inyangana* subsp. *inyangana* fire must be one of the major causes of some of the morphological variability displayed by the populations investigated.

For *O. cupheoides*, I would like to demonstrate the effect of fire using as an example a population occurring on the summit of Pypkop (Woodbush Forest Reserve, Eastern Transvaal; Puff 790211-4/1).

The population, consisting of approximately 75 to 100 individuals and occupying an area of c. 30×50 m, was associated with rocky outcrops. The plants grew in cracks of rocks or in depressions of flat rock slabs where a certain amount of soil could collect (usually associated with *Androcymbium* sp. and *Selaginella dregei*), or at the base of rocks at the rock/adjacent grassland boundary. Judging from fairly "fresh" blackened dead stems of various grassland species, the grassland must have been burnt recently (a few months ago?). The considerable variation displayed by the individual plants could very clearly be correlated with exposure/non exposure to fire.



FIG. 3.

A cushion of *O. cupheoides* from a "fire proof" habitat (population Pypkop, Puff 790211-4/1). The bar represents 100 mm.

While plants from clearly "fire proof" habitats, such as plants growing in the middle of large rock slabs (several metres away from the adjacent grassland) or on top of tall boulders, invariably formed dense cushions or mats (Figs 3 and 4b; roughly 50 % of the individuals of the population), recently burnt plants from the rock/grassland boundary were characterized by having $\pm$ erect, long and unbranched stems arising from a woody base (Fig. 4a; roughly 30 % of the individuals of the population).

Plants from habitats which apparently are not always, but sometimes reached by fire (i.e. growing nearer to the grassy areas and, therefore, not completely out of reach of particularly strong fires) were morphologically intermediate between the above extremes (roughly 20 % of the plants).



FIG. 4.

Individuals of *O. cupheoides* from a habitat (a) exposed to, and (b) protected from fire (population Pypkop, Puff 790211-4/1); b is a portion of the cushion pictured in Fig. 3. a and b: $\times \frac{1}{2}$. Explanations in the text.

Table 2, listing the differences between the two extremes, i.e. individuals clearly exposed to fire and individuals clearly protected from fire, shows that the fire-induced variability largely involves vegetative characters. Variation in the fertile region, length of the inflorescence (i.e. length of the internodes between paired flowers) and size and hairiness of the enlarged, foliaceous calyx lobe, is coupled with the variability in the vegetative region: more elongated inflorescences are associated with longer internodes in the vegetative zone, larger and hairier foliaceous calyx lobes with larger, hairier mid-stem leaves.

Other floral characters such as corolla tube length (4–7 mm) and width (0,3–0,5 mm at the base and 1–1,5 mm below the throat), and corolla lobe size (3–4,3 $\times$ 0,6–1 mm), and to a lesser extent filament and style length, were also found to vary within the population, but this variation was not correlated with exposure/non exposure to fire and almost certainly is purely genetic.

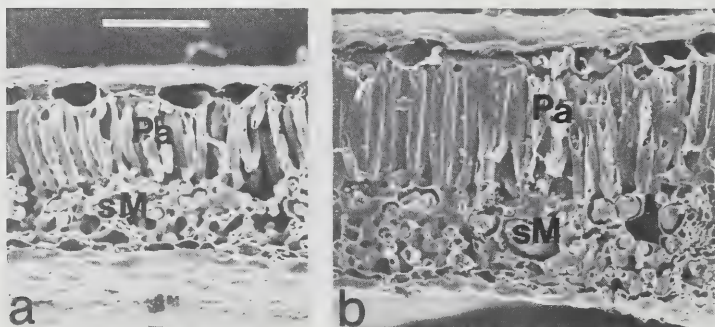


FIG. 5.

Leaf sections of *O. cupheoides* of individuals from a habitat (a) exposed to, and (b) protected from fire (population Pypkop, Puff 790211–4/1). Note the difference in thickness and the much more closely spaced, large palisade cells (Pa) and denser spongy mesophyll (SM) in b. The upper epidermis is covered by a massive, $\pm$ wrinkled cuticle and the outer walls of the epidermis cells are much thickened in b, whereas the cuticle is thin and hardly detectable and the outer walls are not conspicuously thickened in a (this, however, is not clearly visible in the micrographs). The bar represents 0,1 mm; the magnification of a and b is the same.

Other factors, such as substrate or moisture differences (plants growing in rock crevices vs. plants in shallow depressions on top of rock slabs, for example), did not seem to contribute substantially to the variability.

Observations similar to the ones described above were made in the other localities visited: *O. cupheoides* is a species always associated with these rocky

TABLE 2.

Morphological differences between individuals from habitats protected from and exposed to fire of a population of *O. cupheoides* (summit of Pypkop, Woodbush Forest Reserve, Eastern Transvaal; Puff 790211-4/1) In brackets: numbers of individuals investigated.

	protected from fire (27)	exposed to fire (13)
habit	mats or cushions, c. 100–150 mm tall; stems woody, $\pm$ prostrate, much-branched. Figs 3 and 4b	$\pm$ erect stems arising from woody base, c. 190–300 mm tall; usually unbranched. Fig. 4a
stems diam. at base	c. (3) 5–7 mm	c. 1–1.5 mm
longest internodes	(2) 4–8 (10) mm	(25) 30–40 mm
hairs length	in 2 rows or all over, only near tips of branches; 0.3–0.4 mm	all over, whole length of stems; 0.6–0.8 mm
short shoots produced in axils of midstem leaves	none	present nearly at each node
leaves size	11–15 $\times$ 4.5–5 mm	15–21 $\times$ 8–10 mm
shape	lanceolate	ovate-lanceolate
hairs	none or very few on midrib above	midrib above and below, margin (few); sometimes also on upper surface
texture	(sub)coriaceous; also see Fig. 5b	$\pm$ membranaceous; also see Fig. 5a
inflorescences	15–30 (45) mm (fruiting)	(30) 60–80 mm (fruiting)
pedicels, length	0.5–0.7 mm	0.8–1 mm
enlarged, foliaceous calyx lobes	3.5–5 $\times$ 1.2–1.5 (2) mm	4.5–5.5 $\times$ 1.5–2.2 mm

areas. The majority of individuals in a population were almost always found in "fire-proof" situations, whereas relatively few were in habitats that are in reach of at least exceptionally strong fires. Plants exposed to fires were always similar to the forms described above (Fig. 4a), although the differences between cushion- and mat-forming plants and fire-exposed plants were not always as "extreme" as in the Pypkop example.

In contrast to *O. cupheoides*, *O. inyangana* subsp. *inyangana* is primarily a plant of regularly (or at least occasionally) burnt grasslands. Sometimes, however, plants are also found in habitats not reached by fires such as "grassy islands" surrounded by large areas of solid rock. An example is the population of *O. inyangana* on the summit of Castle Beacon, Vumba Mts. (Puff 790128-1/4): once again, the morphological differences between individuals exposed to and protected from fires are striking (Table 3; Fig. 6). The differences observed were largely the same as in *O. cupheoides*, although (with subsp. *inyangana* being primarily a plant of burnt grasslands) woody-stemmed forms were the exception rather than the rule.

TABLE 3

Morphological differences between individuals from habitats protected from and exposed to fire of a population of *O. inyangana* subsp. *inyangana* (summit of Castle Beacon, Vumba Mts.; Puff 790128-1/4). In brackets: numbers of individuals investigated.

	protected from fire (5)	exposed to fire (10)
habit	$\pm$ erect, woody stems, to c. 750 mm long; much-branched. Fig. 6a	erect, non-woody stems, to c. 300-400 mm long; usually unbranched. Fig. 6b
stems diam. at base	c. (2) 3-5 mm	c. 1-2 (2,5) mm
longest internodes	(4) 6-10 mm	(18) 20-30 (32) mm
hairs	hairy all over, only near tips of branches;	hairy all over, upper two thirds of stems;
length	0,4-0,6 mm	0,5-0,8 mm
short shoots produced in axils of midstem leaves	none or very few	present at each node
leaf arrangement	always decussate	in whorls of 3 on most stems
leaves size	7-11 $\times$ 3,8-4,5 mm	12-16 (19) $\times$ 7-9 mm
shape	ovate-lanceolate	$\pm$ ovate
hairs texture	none or few on midrib below —	midrib below and usually also on upper surface —
inflorescences	ca. 10-15 mm; few-flowered	ca. 20-25 mm; many-flowered
enlarged, foliaceous calyx lobes	3-5 $\times$ 1,5-2 mm	4-6 $\times$ 1,5-2,5 mm



FIG. 6.

Individuals of *O. inyangana* subsp. *inyangana* from a habitat (a) protected from, and (b) exposed to fire (population Castle Beacon, Puff 790128-1/4). a and b: $\times \frac{1}{2}$. Explanations in the text.

Because of the peculiar topography of the locality, the number of morphological intermediates was markedly less (10 % or less of the individuals) than in the Pypkop population of *O. cupheoides*.

According to my field observations, *O. calycophylla* subsp. *calycophylla* nearly always occurred in habitats clearly out of reach of fire. Individuals that had been exposed to fire were never observed by me in the field, but some collections (*Esterhuysen* 21445 or *Strey & Schlieben* 8529 from the Blouberg, or *Gillett* 4729 from the Soutpansberg) almost certainly represent fire exposed forms.

O. calycophylla subsp. *verdcourtii* was always found in open, sometimes rocky grassland subjected to fires. Correspondingly, the plants were similar in habit to *O. inyangana* subsp. *inyangana*: after burning, numerous $\pm$ erect flowering stems arise from often massive woody bases. The ($\pm$ moderate) variability displayed by the subspecies, therefore, is either purely genetic or may be attributed (to a certain extent) to other unknown environmental influences.

The Influence of Environmental Factors Other Than Fire Light

All taxa studied in the field were found to occur in full sunlight with the exception of some Magaliesberg populations of *O. calycophylla* subsp. *calycophylla*. These were encountered on perpendicular rock faces of wooded kloofs: individuals growing near the top of the rock faces were fully exposed to the sun, while individuals growing near the bottom of the gorges were in the shade of tall trees for most of the day. Individuals of a population growing in shade could often be distinguished from those growing in sun by their thinnish stems with widely spaced, large and membranaceous leaves and very few-flowered inflorescences.

The inconsistent occurrence of such large-leaved forms in shady habitats may indicate that light is not the only factor involved. It is possible that soil moisture (degree of dampness of shade habitats) has a certain influence but this was not checked.

Altitude

The population of *O. inyangana* subsp. *inyangana* occurring from the eastern base of Mt. Inyangani to the summit plateau (*Puff* 790125–1/2a-f) was studied in detail. Samples were collected at six different stations between 2 150 and 2 580 m altitude; all collections originated from recently burnt grassy areas.

An analysis of these gatherings showed that there is a $\pm$ continuous decrease in plant height with increasing altitude. The tallest plants occur in the lowest altitudes, small, mat- or cushion-forming individuals are confined to the highest altitudes (compare Figs 7a and b). In the latter, shorter internodes in the vegetative region are associated with shorter, fewer-flowered inflorescences. The



FIG. 7.

Two individuals from the population of *O. inyangana* subsp. *inyangana* stretching from the E base of Mt. Inyangani to the summit plateau (Puff 790125-1/2). a: from the E base (2 150 m), b: from the summit (2 580 m). a and b: $\times \frac{1}{2}$. Explanations in the text.

leaves of cushion- or mat-forms are relatively shorter and wider; they are always arranged decussately, whereas individuals from lower altitudes have, at least on the main-stems, the leaves arranged in whorls of three.

TAXONOMY

Otiophora Zucc.¹

Dwarf shrubs, under-shrubs or perennial herbs with massive, woody bases. *Stems* much- to few- or unbranched, $\pm$ terete to obscurely 4-angled; at least younger parts covered with yellowish to whitish, $\pm$ spreading or curled multicellular hairs, older parts often becoming glabrous, dark brown to dark grey, with the epidermis flaking off. Stems and lateral branches often with $\pm$ inconspicuous short shoots. *Leaves* decussate, in true whorls of 3(4) or pseudoverticillate (owing to presence of well-developed short shoot leaves); *petioles* very short or obsolete; blades variable in size and shape, $\pm$ ovate to linear-lanceolate, $\pm$ acute to obtuse at the apex, membranaceous to coriaceous, with 2-4 usually $\pm$ indistinct lateral veins on either side of the midvein, glabrous or hairy on margins, veins or surfaces, margins $\pm$ flat to slightly revolute; *stipules* divided into 3-5(-7) gland-tipped $\pm$ linear segments (setae), the median seta usually (much) longer than the others. *Inflorescences* head- or spike-like, usually elongated when in fruit. *Buds* with a limb abruptly expanded into a $\pm$ pyriform, ovoid or subcylindrical head, distinct from the tube, or claviform, limb and tube not distinct from each other. *Flowers* (strongly) protandrous, on short, persistent pedicels; *calyx lobes* 5, one enlarged, foliaceous (sometimes flanked by a second, slightly enlarged lobe), other lobes minute, setiform; *corolla* 5-merous, glabrous or throat of corolla and corolla tube hairy inside, tube distinctly filiform or narrowly infundibuliform, lobes ($\pm$) lanceolate to oblong, ($\pm$) acute at the apex; *stamens* 5, exserted, *filaments* inserted at/near the throat, filiform, $\pm$ erect and stiff, glabrous or hairy near the base, anthers oblong, yellowish to whitish; *style* glabrous, filiform, stigma bifid, lobes filiform; *ovary* bilocular (but one carpel sometimes smaller and $\pm$ reduced), sparsely to densely covered with short, whitish hairs. *Fruits* splitting into two mericarps; mericarps dorsally convex, ventrally plane or slightly concave. *Seeds* $\pm$ oblong to $\pm$ ovoid, granulated, dorsally convex, sometimes keeled, ventrally flat or (slightly) concave.

KEY TO THE SPECIES AND SUBSPECIES

- | | |
|---|---|
| 1. Corolla tubes distinctly filiform, c. 0.1-0.2 mm wide; buds with a limb (abruptly) expanded into a $\pm$ pyriform, ovoid or subcylindrical head | 2 |
| Corolla tubes narrowly infundibuliform, c. (0.2)0.3-0.5 mm wide at the base and c. (0.6)0.7-1.5(1.8) mm at the throat; buds claviform, limb and tube not distinct from each other | 4 |

¹ Description valid only for southern African taxa.

2. Flowering and fruiting inflorescences lax, spike-like, c. (15)40–150(250) mm long; from tropical Africa extending into Zimbabwe (Rhodesia), also on Madagascar **O. scabra** Zucc. subsp. **scabra** (see footnote, p. 298)
Flowering inflorescences, condensed, head-like, c. 10–25 mm long, fruiting inflorescences often elongated, up to 70 mm long; only in the Transvaal and Natal ... 3
3. Leaves small, (5)7–13(16) × (2)2,5–5(6) mm; foliaceous calyx lobes c. (2,2)2,5–4 mm long; irregularly branched dwarf shrubs with ± much-branched, woody stems; ± widely distributed in the Transvaal and Natal 1A. **O. calycophylla** subsp. **calycophylla**
Leaves larger, (14)16–28 × 5–10 mm; foliaceous calyx lobes c. 3,8–5,5 mm long; perennial herbs or under-shrubs with massive, woody bases and few- or unbranched, ± herbaceous stems; endemic to the eastern Soutpansberg 1B. **O. calycophylla** subsp. **verdcourtii**
4. Throat of corolla glabrous 2. **O. cupheoides**
Throat of corolla distinctly hairy 5
5. Leaves ovate or ovate-lanceolate, (7)10–33 × (3,8)4,5–13 mm, decussate or in whorls of 3(–4) 3A. **O. inyangana** subsp. **inyangana**
Leaves linear-lanceolate or lanceolate, 10–40(47) × 1,6–6(7,5) mm, strictly decussate 6
6. Leaves 10–18 × 1,6–3,5(4) mm; corolla tube (4) 5,5–9 mm long 3B. **O. inyangana** subsp. **parvifolia**
Leaves 23–40(47) × 3–6(7,5) mm; corolla tube (3,2)3,8–4,5(5) mm long 4. **O. lanceolata**

1. **O. calycophylla** (Sond.) Schlecht. & K. Schum. in Bot. Jahrb. **30**: 416 (1901).
Anthospermum calycophyllum Sond. in Fl. Cap. **3**: 31 (1865). Syntypes: Transvaal, Magaliesberg, *Burke & Zeyher* (K!, as *Burke 94*; E!, as *Zeyher 94*; K!, P!, S!, as *Zeyher 1376*), *Sanderson s.n.* (K!, as "Transvaal"), *Sutherland s.n.* (?).

Two subspecies are recognized:

1A. **O. calycophylla** subsp. **calycophylla** (Fig. 9a)

O. hebe Verdc. in J. Linn. Soc. Bot. **53**: 402 (1950). Type: Transvaal, Blauwberg, on rock above Nek and near top of Nek, *Pole Evans 900* (K!, holo.; PRE!).

Several- to many-stemmed, irregularly branched dwarf shrubs. *Stems* ± much-branched, sprawling, ascending to ± erect, (60)100–300(400) mm long, c. 1,5–6 mm in diam. at the base, c. 0,8–1,5 mm in the mid-stem region; hairs c. 0,1 mm, occasionally up to 0,6 mm long, sometimes in two vertical rows. Longest internodes (2)4–20(33) mm. *Leaves* decussate; *petioles* obsolete or c. 0,3–1(1,5) mm long; blades usually spreading, (5)7–13(16) × (2)2,5–5(6) mm, ± ovate to ovate-lanceolate or oblong-lanceolate, coriaceous to subcoriaceous, glabrous, with short forwardly directed hairs on margins and/or upper surface or hairy all over. *Stipular setae* 3–5, c. 0,5–1 mm long, sometimes hairy at the base. *Inflorescences* few- (20- or less-) flowered; condensed, head-like, c. 10 mm or less in diam. when in flower, slightly elongated, c. 10–30(50) mm long when in fruit. *Buds* with a limb (sometimes abruptly) expanded into a pyriform or ±

ovoid head; in near mature buds, tubes c. 1.5–3.5 mm long, heads c. (1)1.3–2.5 × 1–1.8 mm. *Flowers* white, pale pink, mauvish-pink to mauve; enlarged, foliaceous calyx lobe c. (2,2)2.5–4 × 0.9–1.5 mm, ± ovate to ovate-lanceolate, glabrous, with short bristles on margins or (rarely) hairy all over, setiform lobes c. 0.1–0.5 mm, usually glabrous; *corolla* glabrous, tube (2)2.5–5(5.8) mm long, filiform, c. 0.1–0.2 mm in diam. at the base, c. 0.2–0.4(0.5) mm at the throat, lobes (1,5)1.8–3.2(3,7) × 0.4–0.8(1) mm, ± lanceolate; *filaments* c. 1.2–2.5 mm long, glabrous, anthers c. 0.4–0.8(1) × 0.2–0.4 mm; *style* (2,7)3.5–7 mm, stigma lobes c. (0,5)0.8–1.5(2) mm, *ovary* c. 0.8–1.2 × 0.5–0.7 mm, sparsely to densely covered with hairs less than 0.1–0.3 mm long. *Fruits* greenish or brownish; each mericarp (1,5)1.7–2.2(2,4) × (0,7)0.8–1.2 mm. *Seeds* blackish, c. 1.1–1.5 × 0.4–0.5 mm, ± oblong, dorsally convex, ventrally slightly concave.

Chromosome Number: $n = 17$, $2n = 34$.

Average Pollen Diameters: 31.8–34.2 μm .

Habitat: Usually in rock crevices, often on perpendicular rock faces, rock krantzies, cliffs; commonly in shallow, quartzite derived soil mixed with humus; usually growing in full sun, rarely in shady (and ± damp) situations. Ca. 1 200–1 700 m.

Flowering Period: December to March (April); odd flowering specimens also seen from June, July and October.

Distribution (map, Fig. 10): Disjunct. Magaliesberg, Blouberg, and western and central Soutpansberg, Loskopdam; Natal Midlands and Zululand.

Comments: In 1973, Verdcourt raised doubts about the distinctiveness of *O. calycophylla* and *O. cupheoides*. After extensive field observations and critical screening of the herbarium material now available, there is no doubt, however, that the two are distinct entities, a view expressed by Verdcourt (1950) in his original monograph of the genus. While the two may occasionally resemble each other vegetatively to a certain extent (see chapter VARIABILITY), they clearly differ in floral structure: *O. calycophylla* always has a distinctly filiform, narrow corolla tube (Fig. 8a), *O. cupheoides* always an unmistakably narrowly infundibuliform tube, much wider at the throat than at the base. While the buds of *O. cupheoides* are claviform (limb and tube not distinct from each other; Fig. 8b), *O. calycophylla* buds always have filiform tubes clearly distinct from the ± pyriform, ovoid to ± subcylindrical heads (limbs).

In *O. calycophylla*, the bud shape varies slightly in that the tubes either merge gradually into the heads or are expanded abruptly into the heads. It seems that this, to a certain extent, depends on the age of the buds (often difficult to assess!).

Verdcourt's (1950) view that *O. hebe*, although closely allied to *O. calycophylla*, differs in having its "leaves arranged very differently" (p. 402) cannot be upheld. The two collections of *O. hebe* from Blouberg known to Verdcourt are portions of plants with very closely-spaced, quite coriaceous leaves crowded

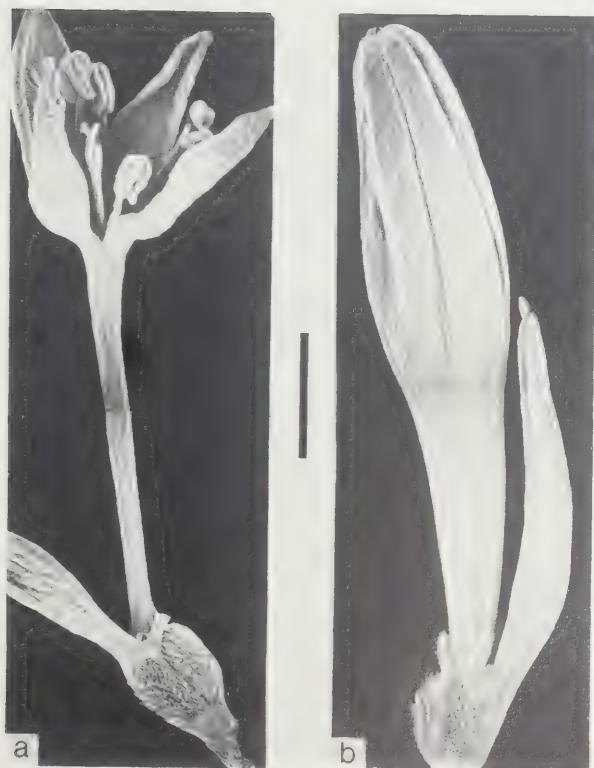


FIG. 8

a: Flower of *O. calycophylla* subsp. *calycophylla* ($\pm$ filiform corolla tube); b: bud of *O. cupheoides* (narrowly infundibuliform corolla tube. The bud is fairly young and the tube has not yet reached its full length; its shape, however, will remain the same). The bar represents 1 mm. (a: Puff 790307-2/1, b: Puff 790211-4/1)

near the tips of the branches. These features are found in and are typical for old, woody plants of *O. calycophylla* subsp. *calycophylla* throughout its whole range of distribution. *O. hebe* and *O. calycophylla* (subsp. *calycophylla*) thus are inseparable vegetatively as well as with regard to floral and fruit characters.

Some unusually large-leaved forms of subsp. *calycophylla* from the Magaliesberg (Marais 297, Repton 708, for example; see chapter VARIABILITY) with shoots with long internodes resemble subsp. *verdcourtii* vegetatively, but are characterized by the small flowers typical for all other Magaliesberg collections. Some collections from the Blouberg and central Soutpansberg are difficult to assign to a subspecies; they may be plants belonging to subsp. *calycophylla* that have been exposed to fire (see VARIABILITY).

The distribution of subsp. *calycophylla*, in contrast to that of subsp. *verdcourtii* and *O. cupheoides*, is a rather disjunct one (see map, Fig. 10). It is of interest to note that there seems to be some correlation between geographic distribution and flower size and colour: Magaliesberg specimens tend to have small, white flowers (although the buds are often tinged pink), specimens from the Blouberg and the western and central Soutpansberg tend to have slightly larger, pink or mauve flowers, and Natal collections have small, pink flowers.

COLLECTIONS

TRANSVAAL—2229 (Waterpoort): road leading off to the W at the Mountain Inn, c. 32 km, Dr. Bird's farm (-DC), Meeuse 9780 (NH, PRE, S); —, c. 13.5 km, between Farms "Alaska" and "Bluegumspoort", c. 1 550–1 600 m (-DD), Puff 791202–3/2 (J); pass N of Louis Trichardt, between Louis Trichardt and Wylies Poort, Gillett 2877 (BOL, NBG).

—2328 (Baltimore): Blouberg, c. 1 700 m (-BB or 2329 -AA), Esterhuysen 21445 (BOL, PRE), Smuts & Pole Evans 869 (PRE, STE; K- as "Pole Evans 869"), Pole Evans 900 (K, PRE; type of *O. hebe*), Scholes sub Puff 781218–1/1 (WU), Strey & Schlieben 8497 (PRE), 8529 (B, PRE, SRGH), van Niekerk 21445 (PRE); —, Mohlakeng Plateau, Codd & Dyer 8982 (PRE).

—2329 (Pietersburg): Soutpansberg, (above) Louis Trichardt (-BB), Breyer 2277 (PRE), Hutchinson 2018 (BOL, K, PRE, SRGH), Koker 9 (PRE); —, Farm "Peover" near Louis Trichardt, Verdoorn 2235 (PRE).

—2527 (Rustenburg): Magaliesberg, Castle Gorge, Farm "Elandskraal 469 JQ" (-AD), van Wyk 116 (PRE); —, Farm "Rainhill" near Rustenburg, c. 1 220 m (-CA), Codd 1078 (PRE); —, Rustenburg Kloof, Collins 7039 (PRE), Prosser 1839 (PRE); —, Rustenburg Nature Reserve, Jacobsen 711 (PRE), 817 (PRE); —, Rustenburg, Tierkloof, Venter 249, 416, 670, 679 (all PRE); —, "Crystal Waters", de Winter 8301 (PRE), Repton 5855 (PRE); —, Bestieg's Kloof, 1 700 m (-CB), Mogg 34474 (J, SRGH); —, above "Bergheim" near Kroondal, Young 27490 (PRE); —, Farm "Kloofwaters", c. 1 500 m (-CD), Puff 790307–2/1 (BR, J, WU), 790706–1/1 (WU); —, Brits Distr., kloof opposite Wolhuterskop turnoff

on Rustenburg road (-DA), *Marais* 287 (PRE); —, —, "Jacksonstuit", *Mogg* 14233 (PRE), *van Vuuren* 172 (PRE); —, Hartebeespoort dam, near "Jacksonstuit" (-DA/-DB), *Repton* 708 (PRE); —, Hartebeespoort dam (-DB), *Pienaar* 863 (PRE). Imprecise localities (2527-C or -D): Rustenburg Distr., Magaliesberg, *Burke* 94 (K; type of *O. calycophylla*), *Esterhuysen* 15569 (BOL), *Nation* 64 (BOL, K), 216 (K, MO), *Zeyher* 94 (E; type of *O. calycophylla*), 1376 (K, P, S; type of *O. calycophylla*).

—2528 (Pretoria): Wonderboom Poort (-CA), *Mogg & Dyer s.n.* sub PRE 41846 (PRE).

—2529 (Witbank): Loskopdam Nature Reserve (-AD), *Mogg* 29534 (J; $\pm$ atypical); —, NE of Tweeloopfontein, *Theron* 1292 (PRE; $\pm$ atypical).

Imprecise localities: Zoutpansberg, *Compton* 18074 (NBG), *Gillett* 4729 (PRE x2), 4730 (PRE x2); "Transvaal", *Sanderson s.n.* (K).

NATAL—2831 (Nkandla): Nkandla, c. 1 220–1 520 m (-CA), *Wylie* sub *Wood* 8866 (BOL, NH).

—2930 (Pietermaritzburg): Ahrens, Farm "Mowbray", c. 1 520 m (-BB), *Fisher* 975 (NH, NU).

1B. *O. calycophylla* subsp. *verdcourtii* Puff, subsp. nov.; habitu saepa erecta, caulibus non ramosis vel ramis lateralibus paucis et internodiis longioribus, foliis (14)16–28 $\times$ 5–10 mm, saepius ellipticis-lanceolatis vel plus minusve lanceolatis, calycis lobis foliaceis c. 3,8–5,5 $\times$ 1–1,8 mm, et corollae tubo saepius longiore, usque ad 6,5 mm longo, a subsp. *calycophylla* differt. (Fig. 9b)

Type: Transvaal (Venda), Sibasa Distr., Tate Vondo Forest Reserve, 1 160, *Hemm* 352 (PRE, holo.; J).

[*O. calycophylla* sensu Hutch., Botanist S. Afr. 671 (1946), quoad pl. cit. solum (*Hutchinson* 4150a). "14. *Otiophora* sp.". Verdc. in J. Linn. Soc. Bot. 53: 411 (1950). (*Hutchinson & Gillett* 4367, K!).]

Usually many-stemmed, erect to $\pm$ sprawling perennial herbs or undershrubs with a massive, woody base up to c. 20 mm in diam. Stems few- or sometimes unbranched, 260–400 mm, c. 0,8–3,5 mm in diam. at the base, c. 0,8–1 mm in the mid-stem region; hairs c. 0,2–0,4 (0,6) mm long, in two vertical rows or stems hairy all over. Longest internodes 15–45 mm. Leaves decussate; petioles c. 0,5–1,5 mm long; blades spreading to ascending, (14) 16–28 $\times$ 5–10 mm, ovate-lanceolate and broadest near the base, elliptic-lanceolate and broadest near the middle, or $\pm$ lanceolate, subcoriaceous, glabrous or hairy on midvein above and/or below, or with scattered hairs on upper surface. *Stipular setae* 3–5, c. 0,7–1,7 mm long. *Inflorescences* c. 20- to 30-flowered; head-like, c. 10–25 mm in diam. when in flower, elongated, rather spike-like, c. 20–70 mm long when in fruit. Buds with a limb $\pm$ abruptly expanded into a $\pm$ ovoid to subcylindrical head; in near mature buds, tubes c. 1,5–2 mm long, heads c. 2–2,5 $\times$ 1–1,5

mm. Flowers pink, (pale) lilac or mauve; enlarged, foliaceous calyx lobe c. 3,8–5,5 × 1–1,8 mm, ± lanceolate to ± ovate-lanceolate, glabrous or sometimes a little hairy on the margins, setiform lobes c. 0,2–0,7 mm long, glabrous; corolla glabrous, tube 3,8–6,5 mm long, filiform, c. 0,2 mm in diam. at the base, c. 0,3–0,4 (0,5) mm at the throat, lobes 2,5–4 × 0,5–0,9 mm ± lanceolate; filaments c. 1,5–3 mm long, glabrous, anthers c. 0,5–1,1 × 0,3–0,5 mm; style 7–8,5 mm, stigma lobes c. 1–2 mm, ovary c. 0,8–1 × 0,5–0,7 mm, ± glabrous to densely covered with hairs c. 0,1–0,2 mm long, the carpel crowned by the enlarged calyx lobe sometimes less hairy than the other. Fruits greenish, greenish-brown to dark brown; each mericarp c. 1,7–2,2 × 0,8–1,2 mm. Seeds blackish, c. 1,2–1,6 × 0,4–0,6 mm, ± oblong, dorsally convex, ventrally slightly concave.

Chromosome Number: $n = 17$, $2n = 34$.

Average Pollen Diameters: 32,4–33,6 μm .

Habitat: In (rocky) grassland; often in sandy loam; usually growing in full sun. Ca. 750–1 500 m.

Flowering Period: October to February; odd flowering specimens seen from July and August.

Distribution (map, Fig. 10): Endemic to the eastern Soutpansberg (high rainfall areas).

Comments: As far as habitat and distribution are concerned, subsp. *verdcourtii* is well demarcated from subsp. *calycophylla*: The subspecies occurs primarily in grassland and is (presumably¹) endemic to the eastern and much wetter part of the Soutpansberg range. Floral characters (filiform corolla tubes) accentuate the close relationship to subsp. *calycophylla*; subsp. *verdcourtii*, in general, has slightly longer corolla tubes and larger lobes, but there is some overlap with the other subspecies. Vegetatively, typical forms of the two subspecies are easily distinguished by differences in habit (compare Figs 9a and b), internode lengths and leaf size and shape, but again, this is not always so. I, therefore, have hesitated to raise *verdcourtii* to species rank.

COLLECTIONS

TRANSVAAL—2230 (Messina): Entabeni (-CC), *Hutchinson 4150a* (?K), *Taylor 715* (PRE); Piesanghoek, c. 1 220 m, *Gerstner 5737* (PRE); Sibasa (Distr.), Mt. N. of Pepiti (=Phiphidi), c. 900–1 500 m (-CD), *Hutchinson & Gillette 4367* (K), *Smuts & Gillett 3249* (PRE, STE), *3270* (PRE), *3270** (PRE, STE); —, Tate Vondo For. Res., Tate Vondo, 1 100 m, *Hemm 352* (J, PRE);

¹ Collections of subsp. *verdcourtii* with precise information on collecting localities all originate from the eastern part of the Soutpansberg range; if others, only stating "Soutpansberg" as locality, in fact do come from the eastern part, is impossible to determine. On my own collecting trips, I have found subsp. *verdcourtii* only in the wet eastern part, and subsp. *calycophylla* only in the much drier, western part of the Soutpansberg.



FIG. 9.

Individuals of *O. calycophylla* subsp. *calycophylla* (a) and subsp. *verdcourtii* (b) in their natural habitat. a: a large-flowered form from the western Soutpansberg (Puff 791202-3/2), b: a plant from the grassland near Vondo Lookout (= $\pm$ type locality: Puff 791201-1/1). The bar represents 50 mm in a and 100 mm in b.

type of ssp. *verdcourtii*); —, Vondo Plantation, near Vondo Lookout, c. 1 150 m, *Puff* 791201-1/1 (J); —, —, edge of Tate Forest ("Holy Forest"), c. 1 300 m, *Puff* 791201-3/1 (J); —, —, Tshamanyatsha Plantation, c. 1 000-1 200 m, *Puff* 791201-4/2 (J), -5/1 (J); —, summit of Khongoroni Mt., c. 1 450 m, *Puff* 791202-2/2 (J); Muchimdudi Falls, c. 1 220 m, *Bruce & Kies* 10 (PRE); (Lake) Funduzi, *Bremekamp & Schweickerdt* 364 (PRE); Makonde (Mission Station), c. 760 m (-DC), *van Warmelo* 5116/7 (PRE); —, top of Makonde Hill, c. 900 m, *Codd* 6864 (PRE, SRGH).

—2329 (Pietersburg): Louis Trichardt (Distr.), Hangklip, c. 1 700 m, *Gerstner* 5993 (PRE), *Bremekamp & Schweickerdt* 430 (PRE ×2); —, Bonzberg, *Moss* 14588 (J ×2).

—2330 (Tzaneen): 15 km E of Louis Trichardt (-AA), *Schlieben* 7331 (BR, J); Tshakoma (-AB), *Obermeyer* 30107 (PRE).

Imprecise locality: Zoutpansberg, *Gillet* 4737 (PRE ×2).

Localities not traced: Louis Trichardt Distr., Farm "Rustfontein", Zoutpansberg plateau, *Schlieben & Strey* 8355 (B, G, PRE, SRGH, W); Luvimbi, *Junod* 21121 (PRE).

2. *O. cupheoides* N.E.Br. in Hook. Icon. Plant **15**: t. 1454, 1884). Type: Transvaal, Houtbosch, *Rehmann* 5901 (K!, holo.; BOL!).

O. hirsuta Bär in Vierteljahresschr. naturforsch. Ges. Zürich **68**: 435 (1923). Type: Transvaal, Shilouvane, rocks at Marovoung and Mamotsui, *Junod* 856 (Z!, holo.; K).

O. cupheoides var. *hirsuta* (Bär) Verdc. in J. Linn. Soc. Bot. **53**: 40 (1950).

O. densiflora Bär in Vierteljahresschr. naturforsch. Ges. Zürich **68**: 436 (1923). Type: Transvaal, Shilouvane, *Junod* 856a (Z!, holo.).

O. cupheoides var. *macrosiphon* Verdc. in J. Linn. Soc. Bot. **53**: 400 (1950). Type: Transvaal, Saddleback Range, Barberton, 5 000 ft., Galpin 729 (K!, holo.; BOL!, PRE ×2!, SAM!).

Several- to many-stemmed, sprawling, mat- or cushion-forming dwarf shrubs; sometimes perennial herbs with massive woody bases up to 20 mm in diam. *Stems* much-branched (few- or unbranched in fire-exposed individuals), 80-450 (600) mm long, c. (1) 1.5-5.5 (7) mm in diam. at the base, c. 0.8-1.5 mm in the mid-stem region; hairs c. 0.3-0.8 mm long, in two vertical rows or stems hairy all over. Longest internodes c. (2) 4-25 mm (typical forms), or c. (20) 30-40 (45) mm (fire-exposed individuals). *Leaves* decussate; petioles obsolete or 0.5-1.5 (2) mm long; blades ± spreading, (9) 11-22 (36) × (3.5) 4-8 (13) mm, ovate-lanceolate and broadest near the base or ± lanceolate, glabrous or hairy on margins, midvein above and/or below, lateral veins, upper surface, or with a dense cover all over. *Stipular setae* 3-5 (-7), the longest c. 0.7-1.8 mm, glabrous or sometimes a little hairy. *Inflorescences* few- to many-flowered;

head-like, c. 10–20 mm in diam. when in flower, sometimes much elongated, spike-like, up to 45 (60) mm (typical forms) or to c. 120 (170) mm (fire-exposed individuals) long when in fruit. *Buds* claviform. *Flowers* white (sometimes tinged pink, reddish or faint purple when in bud); enlarged, foliaceous calyx lobe c. (3,5) 4–8 (10) $\times$ (1) 1,2–2 (2,2) mm, $\pm$ lanceolate, glabrous or a little hairy, setiform lobes (0,2) 0,4–0,8 (1,2) mm long, usually glabrous; *corolla* glabrous, tube 4–12 mm long, narrowly infundibuliform, (0,2) 0,3–0,4 (0,5) mm in diam. at the base, (0,6) 0,8–1,5 (1,8) mm at the throat, lobes (2,5) 3–4,6 (5,5) $\times$ 0,6–1,2 mm, lanceolate or oblong-lanceolate; *filaments* c. (2,5) 2,8–3,5 (4,2) mm long, glabrous, anthers c. 0,6–0,9 $\times$ 0,2–0,4 mm; *style* 7–12 (15) mm, stigma lobes c. (0,7) 1–1,5 (2) mm, *ovary* c. 0,7–1,2 $\times$ 0,5–0,8 mm, sparsely to densely covered with hairs c. 0,2–0,5 mm long, the carpel crowned by the enlarged calyx lobe sometimes less hairy than the other, smaller, $\pm$ reduced. *Fruits* greenish, brownish or blackish; each mericarp 1,8–2,5 $\times$ 0,8–1,2 mm, the mericarp crowned by the enlarged calyx lobe sometimes smaller, without seed. *Seeds* black or brownish-black, c. 1,2–1,4 $\times$ 0,5–0,7 mm, $\pm$ ovoid to oblong, dorsally convex, ventrally plane to strongly concave.

Chromosome Number: $n = 17$, $2n = 34$.

Average Pollen Diameters: 32–33,4 μm .

Habitat: Usually in cracks of rocks or depressions of flat rocks; in rocky outcrops, or in rocky grassland in rock clumps or between rocks; usually in shallow (black reef) quartzite or granite (and sandstone?) derived soil mixed with humus; normally growing in full sun. Ca. 1 100–2 150 m.

Flowering Period: November to April; odd flowering specimens also seen from June, July and September.

Distribution (map, Fig. 10): Along the Drakensberg escarpment from the eastern Transvaal to Swaziland.

Comments: Neither var. *macrosiphon* nor var. *hirsuta* should be retained.

Within the species, there is a continuous range of corolla tube lengths from 4 to 12 mm, making it highly artificial to separate plants with longer corolla tubes as var. *macrosiphon*. Corolla tube lengths were, furthermore, also found to vary considerably within individual plants and within populations.

Hairiness of the stems ranges from two lines of hairs to a denser cover, hair lengths from c. 0,3–0,8 mm. Leaves are either glabrous or have hairs along the veins, along the veins and scattered on the surfaces, or are densely hairy all over. Again, hairiness can vary within a population (see Table 2). The population of *O. cupheoides* in the Mamotswiri Peak area (Puff 791208–1/1; type locality of *O. hirsuta*) consists of plants that are indeed hairier than all others within the species, but it does not seem justified to separate this population as var. *hirsuta*, if the variability of the indumentum within the species as a whole is taken into account.

The range of distribution of *O. cupheoides*, following the Drakensberg

escarpment from the eastern Transvaal to Swaziland, is a very closed and well-defined one. The only collection, seemingly "out of place", *Rogers 19055* from "Waterberg Div., Leeupoort, Sept. 1917" may well have come from The Downs. The collection is inseparable from *Rogers 20185* and *22076*, both from The Downs. A comparison of collection numbers, collecting localities and dates makes a mixup of labels seem likely: *Rogers 19055*, supposedly from Leeupoort, was collected in September 1917, whereas *Rogers 20185*, the higher collection number, is dated July 1917; *Rogers 22076* was collected in December 1917.

Floral characters (claviform buds, narrowly infundibuliform corolla tubes) suggest a closer affinity of *O. cupheoides* to the species endemic to the Eastern Highlands of Zimbabwe (Rhodesia) and neighbouring Moçambique than to the South African *O. calycophylla*. *O. cupheoides*, *O. inyangana* and *O. lanceolata* are the only species in the genus with claviform buds and narrowly infundibuliform corolla tubes. Within this group, *O. cupheoides* is distinguished by having glabrous corollas.

COLLECTIONS

TRANSVAAL—2329 (Pietersburg): Iron Crown Mine, S of Haenertsburg, c. 1 850 m (-DD), *Mogg 16642* (PRE, SRGH); near summit of Iron Crown Mt., *Meeuse 9835* (PRE, S, SRGH); Houtbosch, *Rehmann 5901* (BOL, K; type of *O. cupheoides*); —, Kooimans Gat hill, c. 1 850 m, *Mogg 17200* (PRE); Houtboschberg, c. 2 150 m, *Schlechter 4456* (BOL, BR, GRA, PRE as "2317" = Tvl. Museum No.).

—2330 (Tzaneen): near Duiwelskloof, Grootbos Govt. For. Res., W of Westfalia Estate boundary, c. 1 620 m (-CA), *Scheepers 846* (BR, MO, PRE, SRGH, W); Woodbush For. Res., summit of Pypkop, c. 1 820 m (-CC), *Prosser 1920* (PRE), *Puff 790211-4/1A, -4/1B* (J, WU); Wolkberg near Haenertsburg (-CC or 2429-BB or 2430-AA), *Müller & Scheepers 189* (PRE), *Swart s.n.* (J).

—2430 (Pilgrim's Rest): The Downs, c. 1 350 m (-AA), *Junod 4265* (PRE × 3; 2 sheets as "19971" = Tvl. Museum No.), *Nel 100* (STE), *Rogers 20185* (GRA, PRE), *22076* (BOL, J, PRE, SAM, STE); The Downs area, *Puff 790210-4/2* (WU); —, Mamotswiri Peak above Farm "Hoffenden Heights", c. 1 700–1 800 m, *Puff 791208-1/1* (K, WU); Shilouvane, rocks at Marouvogne and Mamotsuiri, *Junod 856* (K, Z; type of *O. hirsuta*), *856a* (Z; type of *O. densiflora*); mts. near Trichardsdal, The Downs, 1 800 m (-AC?), *Vahrmeijer 2364* (MO, PRE, SRGH); Marieskop, c. 1 500–2 400 m (-DB), *Bos 1031* (B, LISC, PRE, STE), *Meeuse 9982* (PRE), *Merxmüller 593* (LISC, M, PRE), *Killick & Strey 2384* (G, PRE, SRGH), *van Dam 26305* (PRE), *van der Schijff 4523* (PRE, W), *4783* (PRE), *4831* (PRE, W), *6318* (PRE), *Werdermann & Oberdieck 1860* (B, BR, PRE), *1891* (B, PRE); above Pilgrim's Rest (-DD), *Taylor 509* (PRE); Graskop, *Holland s.n.* sub PRE *41844* (PRE), *Nel 125* (STE), *Rogers 20376* (PRE); —, "Edge of Berg", c. 1 600 m, *Galpin s.n.* sub BOL *24793*

(BOL), 14374 (PRE); Graskop Peak, c. 1 850 m, *Galpin* 14385 (PRE); "Fairy-land" (Private Nature Reserve) just outside Graskop, *van Jaarsveld* 1028 (MO, NBG, PRE), *Puff* 790704-1/1 (BR, J, WU); edge of escarpment, c. 1 km E of Graskop, 1 500 m, *Coetzee* 1439 (PRE); c. 17.6 km N of Graskop, c. 1 520 m, *Codd & de Winter* 3348 (PRE); between Pilgrim's Rest and Sabie, c. 1 070 m (-DD/ 2530 -BB), *Rogers* 23687 (BM, J, NH, PRE).

—2530 (Lydenburg): Tweefontein State Reserve near Sabie, 1 600–1 800 m (-BB), *Bernardi* 8976 (G).

—2531 (Komatipoort): Sabie Falls, S edge of gorge (-AA), *Burt Davy* 1553 (PRE); Barberton (-CC), *Thorncroft* 61 (K, NH), 2964 (PRE), 9608 (PRE); Saddleback Range near Barberton, c. 1 520–1 680 m, *Galpin* 729 (BOL, GRA, K, PRE × 2, SAM; type of *O. cupheoides* var. *macrosiphon*), *Puff* 780902-1/1 (BR, J, WU), *Thorncroft* 2183 (K); Ida Deyer Nature Reserve, 38 km SE of Barberton, 1 140 m, *Muller* 2051 (PRE); Barberton Distr., escarpment c. 41.5 km SE of Barberton, c. 1 220 m, *Lewis* 6333 (K, MO); —, near Havelock Mine, Transvaal side of border, c. 1 450 m, *Bayliss* 2745 (NBG).

Not traceable/doubtful localities: "Berg Plateau", *Mudd s.n.* sub BOL 24794 (BOL, K); Div. Waterberg, Leeupoort, *Rogers* 19055 (PRE).

SWAZILAND—2531 (Komatipoort): Piggs Peak Distr., Emlembe, c. 1 700 m (-CC), *Compton* 28496 (NBG, PRE); —, Emlembe Hill, Devils Bridge, *Hilliard & Burt* 3583 (E, NU); —, Havelock, c. 1 220 m, *Compton* 30636 (NBG, PRE, SRGH); —, Havelock road, c. 1 370 m, *Compton* 27678 (NBG); —, c. 5 km W of Piggs Peak, c. 1 250 m, *Compton* 7823 (PRE, SRGH); —, Peak Timber Plantations, A5 Section, Kobolodo Peak, c. 1 150 m, *Puff* 770118 -3/8 (WU).

—2631 (Mbabane): Mbabane Distr., Ngwenya Mt., c. 1 700–1 800 m (-AA), *Compton* 26529, 26682 (both NBG, PRE), *Puff* 790225-1/3 (WU); —, Bomvu Ridge, c. 1 700 m, *Compton* 32013 (NBG, PRE); Hlatikulu, c. 1 400 m (-CD), *Stewart* 54 (K, SAM).

Imprecise locality: "Swaziland", *Stewart* 9527 (PRE).

3. *O. inyangana* N.E. Br. in Kew Bull. 1906: 107 (1906). Type: Zimbabwe (Rhodesia), Manika Distr., Inyanga Mts., 6 000–7 000 ft., *Cecil* 203 (K!, holo.).

Two subspecies are recognized:

3A. *O. inyangana* subsp. *inyangana*

Usually many-stemmed, ± erect perennial herbs or under-shrubs with often branched, massive woody bases, c. 10–20 mm in diam., distinctly yellow in cross section; occasionally much-branched dwarf shrubs, sometimes forming cushions or mats. Stems generally few- or unbranched, 150–600 (750) mm long, c. (1) 1.5–4 (5) mm in diam. at the base, c. 0.8–1.5 (2) mm in the mid-stem region; hairs c. 0.4–0.8 mm long, in two vertical rows, or stems hairy all over. Longest

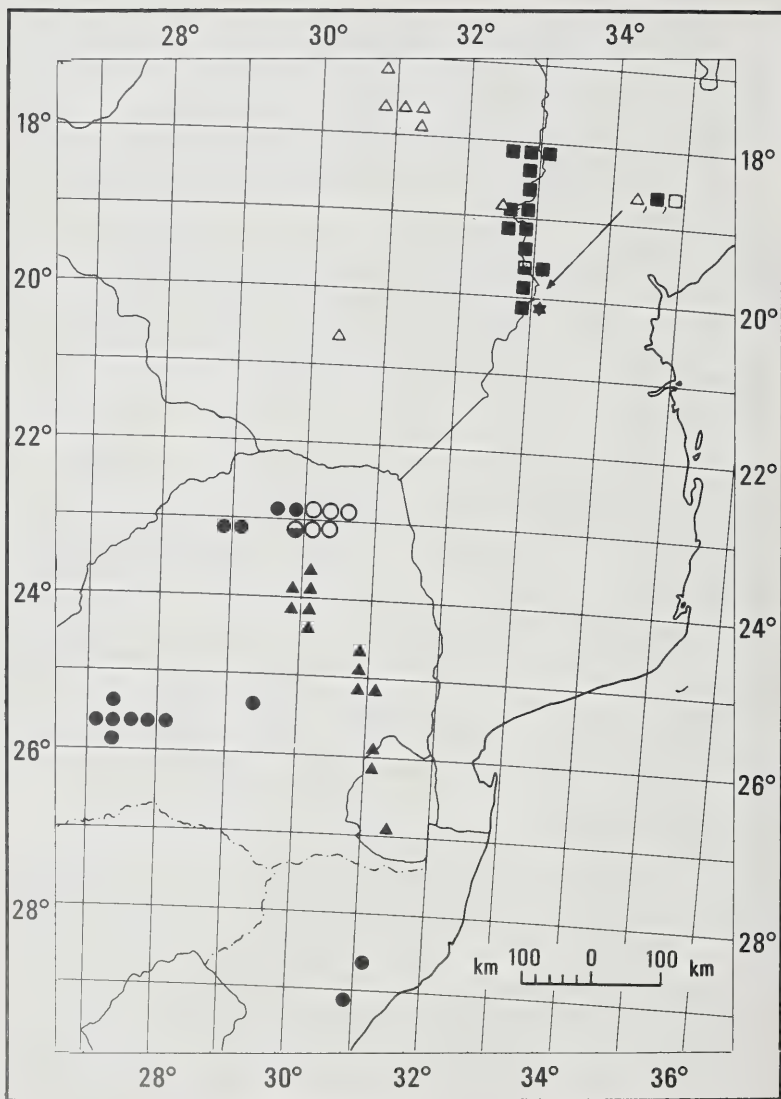


FIG. 10.

Distribution of *O. calycophylla* subsp. *calycophylla* (●) and subsp. *verdcourtii* (○; ⊙: both subspecies), *O. cupheoides* (▲), *O. inyangana* subsp. *inyangana* (■) and subsp. *parvifolia* (□; ▣: both subspecies), *O. lanceolata* (★), and *O. scabra* subsp. *scabra* (△; southern Africa only).

internodes c. (15) 20–40 (60) mm (typical forms), or c. (4) 6–15 mm (dwarf shrubs, cushion-forming plants). *Leaves* decussate or in whorls of 3 (4), but sometimes apparently in whorls of 6 or more owing to presence of well-developed short shoot leaves; *petioles* c. 0.5–1.5 (2) mm or obsolete; blades erect, ascending or spreading, (7) 10–33 × (3.8) 4.9–13 mm, ovate to ovate-lanceolate, broadest at lower third or near the middle, glabrous or hairy on midvein, lateral veins and (occasionally) upper surface. *Stipular setae* 3 (–4–5), the longest c. 0.3–2 mm. *Inflorescences* usually many-flowered, often in groups of 2–3 (or more); head-like, c. (10) 20–40 mm in diam. when in flower, often much elongated, spike-like, c. 30–50 mm, occasionally up to 120 mm long when in fruit. *Buds* claviform. *Flowers* whitish, pale pink, pink, pale blue, mauve or purplish; enlarged, foliaceous calyx lobe c. (3.5) 4–8 × 0.8–2.2 (3) mm, ovate-lanceolate to lanceolate, often glabrous, setiform lobes c. 0.2–1 mm long; *corolla* usually glabrous outside, sometimes with a few hairs near the apex, throat of corolla and at least upper half of corolla tube ± densely hairy inside, tube (3.5) 4–6.5 (8) mm long, narrowly infundibuliform, c. 0.2–0.3 mm in diam. at the base, c. 0.5–1.2 mm at the throat, lobes (2.5) 3–5.5 × (0.4) 0.6–1.2 mm, lanceolate; *filaments* c. (2.5) 3.5–5.5 (6) mm long, usually hairy near the base, anthers c. 0.5–0.9 × 0.3–0.4 mm; *style* 6.8–11 mm, stigma lobes c. 0.6–1.1 (1.7) mm, ovary c. 0.7–1.2 × 0.5–0.8 mm, sparsely to densely covered with hairs 0.1–0.3 mm, sometimes up to 0.7 mm long, the carpel crowned by the enlarged calyx lobe often less hairy than the other. *Fruits* greenish to brownish; each mericarp 1.5–2.2 × 0.6–1.2 mm. *Seeds* black, c. (1) 1.2–1.4 × 0.5–0.8 mm, ± ovoid, dorsally convex or ± keeled, ventrally flat or concave.

Chromosome Number: $n = 17$, $2n = 34$.

Average Pollen Diameters: 26.6–29.4 μm .

Habitat: Usually in open grassland, sometimes at the edge of forest or scrub; rarely in rocky areas (amongst rocks) or disturbed sites (roadsides or plantations); commonly in clayey soils, (presumably) never on quartzite; usually growing in full sun. Ca. 1 200–2 580 m.

Flowering Period: (September) October to July.

Distribution (map, Fig. 10): Widely distributed and common in the Eastern Highlands of Zimbabwe (Rhodesia) from the Inyanga Distr. south to the Melsetter Distr., and extending across the border into Moçambique.

Comments: Subsp. *inyangana* is highly variable with regard to growth habit (stems erect, sprawling, or plants cushion- or mat-forming), indumentum, leaf shape and size and arrangement of the leaves in opposite pairs or in whorls of three or four, internode lengths, extensiveness of the inflorescence, length of the fruiting inflorescence, and shape and size of the foliaceous calyx lobe. Some of the environmental factors contributing to this plasticity are discussed under VARIABILITY.

Since several of the many “forms” of subsp. *inyangana* are frequently found

even in a single population, it seems unjustified to recognize any of them taxonomically (cf. Verdcourt, 1950: p. 398).

The arrangement of the leaves does not necessarily seem to be correlated with environmental factors. In typical grassland forms, for example, it was observed that stems arising from a common woody base may differ from each other by having their leaves arranged decussately or in whorls of three, or even four. Sometimes, leaf arrangement is not even constant on a single stem: leaves may be decussate below but in whorls of three above. Also the indumentum of leaves on stems arising from a common woody base may vary: on some stems, the leaves may be glabrous, in others slightly hairy.

COLLECTIONS

ZIMBABWE (RHODESIA)—1832 (Umtali): Inyanga (village?), c. 1 830 m (-BA), *Eyles 8510* (K, SRGH), *Hopkins 8652* (SRGH); Inyanga Distr., c. 13 km from Inyanga village along Troutbeck road, c. 2 050 m (-BB), *Rushworth 774* (BR, MO, SRGH); —, Troutbeck, *Rattray 1437* (SRGH); —, on way down to Hammers, *Rattray 937* (SRGH); —, 15 km E of Inyanga, Mt. Mimunzi, c. 1 900 m, *Bamps, Symoens & vanden Berghen 253* (BR, SRGH); —, Nyamaropa Forest Reserve, c. 3.2 km SE of Muozi, c. 2 130 m, *Simon 653* (LISC, PRE, SRGH); —, Farm "Pamushana", c. 1 830 m (-BD), *Miller 3766* (SRGH); —, Rhodes Inyanga Estate (= "Rhodes Estate", "Inyanga Estate"), c. 1 770–1 830 m, *Hopkins s.n.* sub SRGH 7857 (K, SRGH), *Seagrief 3042* (SRGH), *Whellan 589* (SRGH); —, — and at Pungwe Falls, c. 1 800 m, *Fries, Norlindh & Weimarck 2662* (B, S); —, Rhodes Inyanga National Park, around Fort Nyangwe, c. 2 020 m, *Puff 790124–2/1* (WU); —, —, Fort Hill, *West 4403* (LISC, SRGH); —, —, Mt. Inyangani, c. 1 830–2 580 m, *Bamps, Symoens & vanden Berghen 6* (BR, SRGH), *Chase 3709* (BR, MO, SRGH), 4343 (BM, BR, LISC, MO, PRE, SRGH), *Dale SKF 464* (SRGH), *Fries, Norlindh & Weimarck 3523* (B, SRGH), *Pope 1200* (SRGH), *Puff 790125–1/2a-f* (WU); —, —, "Inyanga Mts.", c. 1 830–2 500 m, *Cecil 203* (K; type of *O. inyangana*), *Humbert 15841* (P); —, —, above bank of Nyamingura R., c. 1 280 m, *Phipps 1260* (SRGH); —, —, Mare R., c. 1 860 m, *Wild 1555* (K, SRGH); —, —, Pungwe River, — Gorge, — View or — Hills, c. 1 170–1 830 m, *Hopkins s.n.* sub SRGH 7176 (K, SRGH), sub SRGH 13118 (BR, K, SRGH), *Rutherford-Smith 518* (MO, SRGH), *Schelpé 582* (BOL, LISC, SRGH), *West 6283* (B, SRGH), *Wild 1481* (K); —, —, Circular Drive between Causeway Cottage and S end of Mt. Inyangani, *Puff 790126–1/1* (WU); Stapleford Forest Reserve, "North Patrol", base of Mt. Ruuinji (-DB), *Puff 790127–2/2* (WU); —, edge of pine plantation near "Dandy's Nek", *Puff 790127–3/3* (WU); Stapleford Forest Station, *Taylor 3287 B* (NBG); — Reserve, c. 1 770 m (-DB or -DD), *Brain 9726* (MO, PRE); Stapleford, *Gilliland 285* (SRGH); Penhalonga (-DC), *Wild 548* (K, SRGH); Umtali Distr., "Mountain Home", *Chase 1209* (SRGH); Umtali, c.

1 580 m, Eyles 1180 (K, SRGH); —, “Cloudlands”, c. 1 580 m (-DC or 1932 -BA?), Eyles 5641 (SRGH); Umtali Commonage, “Bideford”, Fisher 1430 (NU, PRE), 1436 (SRGH).

—1932 (Melsetter): Vumba Mts., c. 1 520–1 830 m (-BA or -BB), Chase 7299 (MO, SRGH), Corby 270 (SRGH), Craster s.n. sub SRGH 8714 (SRGH), Ferrar 3960 (PRE), Fisher 1120 (NU, SRGH), Garley 117 (SRGH), Greatrex s.n. sub SRGH 14936 (K, SRGH), Hopkins 8052 (SRGH), s.n. sub SRGH 7078 (K, SRGH); —, summit of Castle Beacon, c. 1 900 m (-BA), Puff 790128–1/4 (WU), Corner s.n. (E); —, Leopard Rock, c. 1 750–1 830 m (-BB), Bamps, Symoens & vanden Berghen 690a (BR), Jacobsen 1486 (PRE); Engwa Farm, Himalaya Mts., c. 1 900–1 980 m (-BD), Exell, Mendonça & Wild 122 (LISC, SRGH), Müller 483 (PRE, SRGH); Banti Forest Reserve (-DB), Mavi 491 (B, SRGH); Chimanimani Mts., Martin Forest Reserve, Mavi 685 (BR, SRGH); Melsetter, c. 1 220 m (-DD), Johnson 170 (K), Walters 2726 (K, SRGH); — Distr., Tarka Forest Reserve, c. 1 220 m, Goldsmith 8/68 (B, LISC, MO, PRE, SRGH); “Gazaland”, Mt. Pene, c. 2 130 m, Swynnerton 2007 (K).

—1933 (Vila Pery): Chimanimani Mts. (-CC), Goodier 206 (LISC, PRE, SRGH), Thompson 23 (PRE, SRGH); —, Base Camp, Manning CH 25 (SRGH); —, near Outward Bound School, Grosvenor 307 (PRE, SRGH); —, Upper Bundi plain, c. 1 680 m, Hall 230 (SRGH); —, Long Gulley, Noel 2151 (SRGH); —, Stonehenge (Plateau), c. 1 680–1 800 m, Phipps 356, 386 (both PRE, SRGH); —, summit of pass, West 3634 (SRGH); —, summit of Mt. Peza, c. 2 175 m, Goodier 502 (PRE, SRGH).

—2032 (Chipinga): Glencoe Forest Reserve (-BB), Drummond 4974 (BR, PRE, SRGH).

MOÇAMBIQUE—1833 (Vila Gouveia): Barue, Serra de Choa, 10 km from Choa towards border, c. 1 300 m (-AA), Torre & Correia 18626 (LISC); —, —, 21–23 km from (Vila) Gouveia towards border, c. 1 500 m, Torre & Correia 13542, 15462 (both LISC).

—1932 (Melsetter): Manica e Sofala, Tsetsera, 2 140 m, Exell, Mendonça & Wild 237 (BM, LISC, SRGH); —, Serra do Rutanda (-DB), Barbosa 1626 (LISC).

—1933 (Vila Pery): Manica e Sofala, Mavita, Mt. Xiroso (-CA), Mendonça 2628 (LISC); —, Chimanimani Mts., between Skeleton Pass and Camp Portage, c. 1 700 m (-CC), Grosvenor 237 (LISC, MO, PRE, SRGH).

3B. *O. inyangana* subsp. *parvifolia* (Verdc.) Puff, stat. nov.

O. inyangana var. *parvifolia* Verdc. in J. Linn. Soc. Bot. 53: 399 (1950). Type: Zimbabwe (Rhodesia), Chimanimani Mts., Munch 87 (K!, holo.; SRGH!).

Many-stemmed, erect or sprawling perennial herbs or $\pm$ cushion-forming

dwarf shrubs with massive woody bases, c. 10–20 mm in diam., distinctly yellow in cross section. *Stems* few- to $\pm$ much-branched, 100–900 mm long, c. 1,5–2 mm in diam. at the base, c. 0,6–1,5 mm in the mid-stem region; hairs c. 0,1–0,5 (0,8) mm long, in two vertical rows, or stems hairy all over. Longest internodes (2) 7–25 mm. *Leaves* strictly decussate but often appearing whorled owing to presence of well-developed short shoot leaves; *petioles* usually obsolete; blades ascending to spreading, $10\text{--}18 \times 1,6\text{--}3,5$ (4) mm, linear-lanceolate or lanceolate, rarely $\pm$ ovate-lanceolate, glabrous. *Stipular setae* 3 (—5), the longest c. (0,5) 0,8–1,8 mm. *Inflorescences* few- (c. 20-) flowered; head-like, c. (10) 15–20 mm in diam. when in flower, often much elongated, $\pm$ spike-like, up to c. 50 (70) mm long when in fruit. *Buds* claviform. *Flowers* white, pink or mauve; enlarged, foliaceous calyx lobe c. $4,5\text{--}7 \times 0,8\text{--}1,2$ mm, linear-lanceolate or lanceolate, glabrous, setiform lobes c. 0,2–1 mm; *corolla* glabrous outside, throat of corolla and at least upper half of corolla tube a little hairy inside, tube (4) 5,5–9 mm long, narrowly infundibuliform, c. 0,2–0,5 mm in diam. at the base, 0,7–1,5 mm at the throat, lobes (2,5) $3\text{--}4,5 \times 0,6\text{--}1,2$ mm, lanceolate; *filaments* c. 2–4 mm long, sometimes a little hairy near the base, anthers c. $0,5\text{--}0,9 \times 0,3\text{--}0,4$ mm; *style* 9–11 mm, stigma lobes c. (0,4) $0,7\text{--}1,8$ mm, *ovary* c. $0,8\text{--}1 \times 0,5\text{--}0,6$ mm, sparsely to densely covered with hairs 0,1–0,4 mm long, the carpel crowned by the enlarged calyx lobe often less hairy than the other. *Fruits* brownish; each mericarp $2\text{--}2,5 \times 0,8\text{--}1$ mm. *Seeds* black, c. $1,3\text{--}1,8 \times 0,4\text{--}0,8$ mm, $\pm$ ovoid, dorsally $\pm$ keeled, ventrally flat.

Chromosome Number: Unknown.

Average Pollen Diameters: 27–31 μm .

Habitat: In open grassland or at the edge of (and sometimes in) scrub, occasionally amongst or around rocks; (presumably) restricted to well-drained sandy soils derived from quartzites (Phipps & Goodier, 1962). Ca. 1 200–1 800 (2 300) m.

Flowering Period: (August) September to June.

Distribution (map, Fig. 10): Endemic to the Chimanimani Mts.

Comments: Subsp. *parvifolia* is distinguished from subsp. *inyangana* and all its “forms” by having always decussately arranged, linear-lanceolate or lanceolate leaves, stems with relatively short internodes and generally fewer-flowered inflorescences.

As far as can be determined from herbarium labels (precise collecting localities and/or ecological notes), subsp. *parvifolia* is confined to quartzite areas, while Chimanimani collections of subsp. *inyangana* seem to originate from areas of schist¹. At least for subsp. *parvifolia*, this is confirmed by the ecological studies of Phipps & Goodier (1962), who state that subsp. *parvifolia* is often co-

¹ Because of the varied geology of the area (cf. Goodier & Phipps, 1962) it is often not possible to determine if a particular collection originated from a schist or quartzite area, even if the collecting locality given is $\pm$ precise.

dominant in higher lying quartzite grasslands. They, however, do not mention subsp. *inyangana*.

Subsp. *parvifolia* and subsp. *inyangana* thus seem to be another example of a pair of vicarious taxa, in which one member is a Chimanimani quartzite endemic; it is comparable to the vicarious species pair *Helichrysum rhodellum* Wild, confined to Chimanimani quartzites, and *H. acervatum* S. Moore, occurring in the Inyangana Mts., the Melsetter Distr. and the Chimanimani Mts., but on Umkondo soils (Wild, 1964).

Since there is a certain amount of overlap in the vegetative characters separating *parvifolia* and *inyangana* (Eyles 8510 from Inyanga, for example, closely approaches *parvifolia*), and since there are no differences in floral and fruit characters (merely the inflorescences tend to differ in extensiveness), *parvifolia* is presently considered a subspecies of *O. inyangana*. I hesitate to elevate *parvifolia* to species rank before the variability of *parvifolia* is studied in the field, and before it is established without doubt that *parvifolia* is in fact confined to quartzite.

COLLECTIONS

ZIMBABWE (RHODESIA)—1932 (Melsetter): Chimanimani Mts., Martin Forest Reserve (-DB), Mavi 621 (LISC, SRGH).

—1933 (Vila Pery): Chimanimani Mts., c. 1 500–2 150 m (-CC), *Bamps*, *Symoens & vanden Berghen* 781 (BR, SRGH), *Guy* s.n. sub SRGH 32 764 (SRGH), *McCosh* 8 (SRGH), *Munch* 87 (K, SRGH; type of ssp. *parvifolia*), *Weiste* s.n. sub SRGH 9121 (SRGH), *West* 3633 (SRGH), *Wild* 2956 (SRGH); —, S approach to higher valley, c. 1 600 m, *Simon* 820 (LISC, PRE, SRGH); —, where upper Bundi leaves plain, ca. 1 600 m, *Phipps* 291 (BR, PRE, SRGH); ± atypical and intermediate to ssp. *inyangana*; —, Long Gully, c. 1 650 m, *Noel* 2150 (SRGH); —, vicinity of Mountain Hut, *Simon* 812 (PRE, SRGH); —, Stonehenge (Plateau), c. 1 700–1 770 m, *Hall* 328 (BOL, SRGH), *Phipps* 358 (SRGH); —, Point 71, *Phipps* 661 (BR, PRE, SRGH); —, immediate vicinity of summit of "Uncontoured Peak", c. 2 300 m, *Goodier* 157 (PRE, SRGH).

MOÇAMBIQUE—1933 (Vila Pery): Chimanimani Mts., E side of Point 71, c. 1 500–2 150 m (-CC), *Hall* 433 (SRGH); —, near Camp Portage, c. 1 600 m, *Simon* 884 (SRGH); —, Martin Falls, *Whellan* 2146 (SRGH); —, unnamed triple falls on tributary below Martin Falls, c. 1 200 m, *Taylor* 1796 (E, NU, SRGH).

4. *O. lanceolata* Verdc. in Garcia de Orta, Sér. Bot. 1: 28 (1973). Type: Moçambique, Manica e Sofala, Makurupini R., c. 5 km from its confluence with Haroni R., E bank, 290 m, *Biegel* 3582 (K!, holo.; BR!, COI, EA, LD, PRE, SRGH!).

Many-stemmed, straggling (sub)shrub. Stems usually much-branched, up to c. 1 m long, c. 1–2 (2,5) mm in diam. in the mid-stem region; hairs c. 0,3–0,8

mm long, in two vertical rows. Longest internodes (20) 35–50 (65) mm. *Leaves* decussate but sometimes appearing whorled owing to presence of well-developed short shoot leaves; petioles obsolete or c. 0.5–1 (1.5) mm; blades spreading to ascending, 23–40 (47) $\times$ 3–6 (7.5) mm, lanceolate or linear-lanceolate, glabrous except for a few short hairs on the margins and midvein above. *Stipular setae* usually 3, c. 0.6–2.5 mm long. *Inflorescences* c. 20- to 30-flowered; head-like, c. 10–20 mm in diam. when in flower, often much elongated, $\pm$ spike-like, up to c. 90 (120) mm long when in fruit. *Buds* claviform. *Flowers* white; enlarged, foliaceous calyx lobe c. 2.5–4 (5) $\times$ 0.3–0.8 mm, $\pm$ lanceolate, glabrous or sometimes with a few hairs on the margins, setiform lobes c. 0.2–1 mm, glabrous; *corolla* glabrous outside, throat of corolla and upper third of corolla tube a little hairy inside, tube (3.2) 3.8–4.5 (5) mm long, narrowly infundibuliform, c. 0.2 mm in diam. at the base, c. 0.8–1.2 mm at the throat, lobes (2.8) 3.2–3.8 $\times$ 0.6–1 mm, $\pm$ lanceolate; *filaments* c. 2.8–3.5 mm long, glabrous, anthers c. 0.6–0.9 $\times$ 0.3–0.5 mm; *style* 6–9 (10.5) mm, stigma lobes c. 0.8–1.5 mm, *ovary* c. 0.7–1 $\times$ 0.5–0.7 mm, $\pm$ densely covered with $\pm$ curled hairs, c. 0.1–0.4 mm long, the carpel crowned by the enlarged calyx lobe sometimes less hairy than the other, occasionally smaller, $\pm$ reduced. *Fruits* brownish; each mericarp 1.5–2 $\times$ (0.4) 0.6–1 mm, the mericarp crowned by the enlarged calyx lobe sometimes without seed. *Seeds* brownish black, c. 1.1–1.3 $\times$ 0.6–0.9 mm, $\pm$ ovoid, dorsally convex, often $\pm$ keeled, ventrally strongly concave.

Chromosome Number: Unknown.

Average Pollen Diameters: 30–30.6 μ m.

Habitat: Usually in wet grassland areas, sometimes on steep (wooded) slopes. Ca. 290–475 m.

Flowering Period: November to January; odd flowering specimens also seen from May, June and August.

Distribution (map, Fig. 10): Endemic to the Haroni-Makurupini area.

Comments: Although closely allied to *O. inyangana*, *O. lanceolata* is easily kept separate by morphological and habitat differences (confined to low altitudes).

The occasional reduction of one carpel (ovule) is not a feature unique to *O. lanceolata* (cf. Verdcourt, 1973), but is also encountered in the other southern African taxa, particularly in *O. cupheoides*.

COLLECTIONS

ZIMBABWE (RHODESIA) and MOÇAMBIQUE. See Verdcourt (1973).

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